

above is applied to the optionally rinsed keratin substance, (iv) the keratin substance is optionally rinsed again, minutes, generally between 3 and 30 minutes, preferably between 5 and 15 minutes.

[0121] If the hair was maintained under tension by external means, these means (rollers, curlers or the like) can be removed from the hair before or after the fixing step.

[0122] Lastly, in the final step of the process according to the invention (step (iv)), which is also optional, the hair impregnated with the oxidizing composition is rinsed thoroughly, generally with water.

[0123] Hair which is soft and easy to disentangle is finally obtained. The hair is wavy.

[0124] The oxidizing composition according to the invention can also be used in a process for bleaching keratin fibres, and in particular the hair.

[0125] The bleaching process according to the invention comprises a step of applying an oxidizing composition according to the invention to the keratin fibres in the presence or absence of an auxiliary oxidizing agent. Conventionally, a second step of the bleaching process according to the invention is a step of rinsing the keratin fibres.

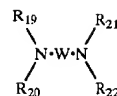
[0126] The medium which is suitable for the keratin fibres (or the support) for the ready-to-use dye compositions and for the oxidizing compositions used for the permanent reshaping or bleaching of keratin fibres in accordance with the invention generally consists of water or of a mixture of water and at least one organic solvent in order to dissolve the compounds which would not be sufficiently soluble in water. By way of organic solvent, mention may be made, for example, of  $C_1$ - $C_4$  alkanols such as ethanol and isopropanol; glycerol; glycols and glycol ethers such as 2-butoxyethanol, propylene glycol, propylene glycol monomethyl ether, diethylene glycol monoethyl ether and monomethyl ether, and aromatic alcohols such as benzyl alcohol or phenoxyethanol, similar products and mixtures thereof.

[0127] The solvents can be present in proportions preferably of between 1 and 40% by weight approximately relative to the total weight of the dye composition, and even more preferably between 5 and 30% by weight approximately.

[0128] The pH of the ready-to-use dye compositions and of the oxidizing compositions used for the permanent reshaping or bleaching of the keratin fibres in accordance with the invention is chosen such that the enzymatic activity of the 2-electron oxidoreductase is not adversely affected. It is generally between 5 and 11 approximately, and preferably between 6.5 and 10 approximately. It can be adjusted to the desired value using acidifying or basifying agents usually used for dyeing keratin fibres.

[0129] Among the acidifying agents, mention may be made, by way of example, of inorganic or organic acids such as hydrochloric acid, orthophosphoric acid, sulphuric acid, carboxylic acids such as acetic acid, tartaric acid, citric acid or lactic acid, and sulphonic acids.

[0130] Among the basifying agents, mention may be made, by way of example, of aqueous ammonia, alkaline carbonates, alkanolamines such as mono-, di- and triethanolamines, 2-methyl-2-aminopropanol and derivatives thereof, sodium hydroxide, potassium hydroxide and the compounds of formula (VI) below:



(VI)

[0131] in which W is a propylene residue optionally substituted with a hydroxyl group or a  $C_1$ - $C_4$  alkyl radical;  $R_{19}$ ,  $R_{20}$ ,  $R_{21}$  and  $R_{22}$ , which may be identical or different, represent a hydrogen atom or a  $C_1$ - $C_4$  alkyl or  $C_1$ - $C_4$  hydroxyalkyl radical.

[0132] The ready-to-use dye compositions and the oxidizing compositions for the permanent reshaping or bleaching of keratin fibres in accordance with the invention can also contain various adjuvants used conventionally in compositions for dyeing, permanently reshaping or bleaching the hair, such as anionic, cationic, nonionic, amphoteric or zwitterionic surfactants or mixtures thereof, anionic, cationic, nonionic, amphoteric or zwitterionic polymers or mixtures thereof, inorganic or organic thickeners, antioxidants, enzymes other than the 2-electron oxidoreductases used in accordance with the invention, such as, for example, peroxidases, penetration agents, sequestering agents, fragrances, buffers, dispersing agents, conditioners, film-forming agents, preserving agents and opacifiers.

[0133] Needless to say, a person skilled in the art will take care to select this or these optional complementary compound(s) such that the advantageous properties intrinsically associated with the compositions in accordance with the invention are not, or are not substantially, adversely affected by the addition or additions envisaged.

[0134] The ready-to-use dye compositions and the oxidizing compositions used for the permanent reshaping or bleaching of keratin fibres in accordance with the invention can be in various forms, such as in the form of liquids, creams or gels, which are optionally pressurized, or in any other form which is suitable for dyeing, permanently reshaping or bleaching keratin fibres, and in particular human hair.

[0135] In the case of a ready-to-use dye composition, the oxidation dyes(s) and the 2-electron oxidoreductase(s) are present in the said composition, which must be free of oxygen gas, so as to avoid any premature oxidation of the oxidation dye(s).

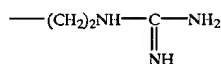
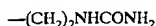
[0136] Concrete examples illustrating the invention will now be given.

[0137] In the text hereinabove and hereinbelow, except where otherwise mentioned, the percentages are expressed on a weight basis.

[0138] The examples which follow illustrate the invention without being limiting in nature.

#### EXAMPLES 1 TO 3 OF DYE COMPOSITIONS

[0139] The ready-to-use dye compositions below were prepared (contents in grams):



[0032] The compounds corresponding to the formula (I) are histidine, lysine, arginine, ornithine and citrulline.

[0033] The compositions in accordance with the invention contain the basic amino acids defined above at weight contents which can be between 0.01% and 20%, preferably between 0.01% and 5% and even more preferably between 0.1% and 3%, relative to the total weight of the composition.

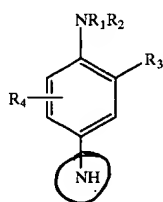
[0034] A subject of the present invention is also a ready-to-use composition for the oxidation dyeing of keratin fibres, and in particular human keratin fibres such as the hair, of the type comprising, in a medium which is suitable for dyeing, at least one oxidation base and, where appropriate, one or more couplers, which is characterized in that it contains:

[0035] (a) at least one enzyme of 2-electron oxidoreductase type in the presence of at least one donor for the said enzyme,

[0036] (b) at least one basic amino acid.

[0037] The nature of the oxidation base(s) used in the ready-to-use dye composition is not a critical factor. They can be chosen, in particular, from para-phenylenediamines, double bases, para-aminophenols, ortho-aminophenols and heterocyclic oxidation bases.

[0038] Among the para-phenylenediamines which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made in particular of the compounds of formula (II) below, and the addition salts thereof with an acid:



[0039] in which:

[0040] R<sub>1</sub> represents a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>2</sub>-C<sub>4</sub> polyhydroxyalkyl radical, a (C<sub>1</sub>-C<sub>4</sub>) alkoxy(C<sub>1</sub>-C<sub>4</sub>) alkyl radical, a C<sub>1</sub>-C<sub>4</sub> alkyl radical substituted with a nitrogenous group, a phenyl radical or a 4'-aminophenyl radical;

[0041] R<sub>2</sub> represents a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>2</sub>-C<sub>4</sub> polyhydroxyalkyl radical, a (C<sub>1</sub>-C<sub>4</sub>)alkoxy(C<sub>1</sub>-C<sub>4</sub>)alkyl radical or a C<sub>1</sub>-C<sub>4</sub> alkyl radical substituted with a nitrogenous group;

[0042] R<sub>3</sub> represents a hydrogen atom, a halogen atom such as a chlorine, bromine, iodine or fluorine atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkoxy radical, an acetyl-amino(C<sub>1</sub>-C<sub>4</sub>)alkoxy radical, a C<sub>1</sub>-C<sub>4</sub> mesylaminoalkoxy radical or a carbamoylamino(C<sub>1</sub>-C<sub>4</sub>)alkoxy radical,

[0043] R<sub>4</sub> represents a hydrogen or halogen atom or a C<sub>1</sub>-C<sub>4</sub> alkyl radical.

[0044] Among the nitrogenous groups of formula (II) above, mention may be made in particular of amino, mono (C<sub>1</sub>-C<sub>4</sub>) alkylamino, di (C<sub>1</sub>-C<sub>4</sub>) alkylamino, tri (C<sub>1</sub>-C<sub>4</sub>) alkylamino, monohydroxy (C<sub>1</sub>-C<sub>4</sub>) alkylamino, imidazolinium and ammonium radicals.

[0045] Among the para-phenylenediamines of formula (II) above, mention may be made more particularly of para-phenylenediamine, para-toluylenediamine, 2-chloro-para-phenylenediamine, 2,3-dimethyl-para-phenylenediamine, 2,6-dimethyl-para-phenylenediamine, 2,6-diethyl-para-phenylenediamine, 2,5-dimethyl-para-phenylenediamine, N, N-dimethyl-para-phenylenediamine, N,N-diethyl-para-phenylenediamine, N,N-dipropyl-para-phenylenediamine, 4-amino-N,N-diethyl-3-methylaniline, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 4-amino-N,N-bis(β-hydroxyethyl)-2-methylaniline, 4-amino-2-chloro-N,N-bis(β-hydroxyethyl)aniline, 2-β-hydroxy-ethyl-para-phenylenediamine, 2-fluoro-para-phenylene-diamine, 2-isopropyl-para-phenylenediamine, N-(β-hydroxypropyl)-para-phenylenediamine, 2-hydroxy-methyl-para-phenylenediamine, N,N-dimethyl-3-methyl-para-phenylenediamine, N,N-(ethyl-β-hydroxyethyl)-para-phenylenediamine, N-(β, γ-dihydroxypropyl)-para-phenylenediamine, N-(4'-aminophenyl)-para-phenylenediamine, N-phenyl-para-phenylenediamine, 2-β-hydroxy-ethyloxy-para-phenylenediamine, 2-β-acetylamino-ethyloxy-para-phenylenediamine and N-(β-methoxyethyl)-para-phenylenediamine, and the addition salts thereof with an acid.

[0046] Among the para-phenylenediamines of formula (II) above, para-phenylenediamine, para-toluylenediamine, 2-isopropyl-para-phenylenediamine, 2-β-hydroxyethyl-para-phenylenediamine, 2-β-hydroxy-ethyloxy-para-phenylenediamine, 2,6-dimethyl-para-phenylenediamine, 2,6-diethyl-para-phenylenediamine, 2,3-dimethyl-para-phenylenediamine, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 2-chloro-para-phenylenediamine and 2-β-acetylaminoethyloxy-para-phenylenediamine and the addition salts thereof with an acid are most particularly preferred.

[0047] According to the invention, the term double bases is understood to refer to the compounds containing at least two aromatic rings bearing amino and/or hydroxyl groups.

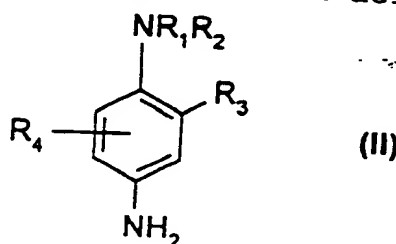
[0048] Among the double bases which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made in particular of the compounds corresponding to formula (III) below, and the addition salts thereof with an acid:

(a) at least one enzyme of 2-electron oxidoreductase type in the presence of at least one donor for the said enzyme,

(b) at least one basic amino acid.

5 The nature of the oxidation base(s) used in the ready-to-use dye composition is not a critical factor. They can be chosen, in particular, from para-phenylenediamines, double bases, para-aminophenols, ortho-aminophenols and heterocyclic oxidation bases.

10 Among the para-phenylenediamines which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made in particular of the compounds of formula (II) below, and the addition salts thereof with an acid:



15 in which:

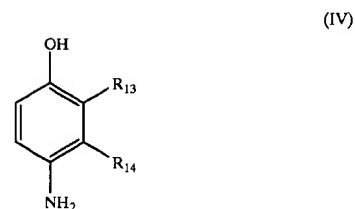
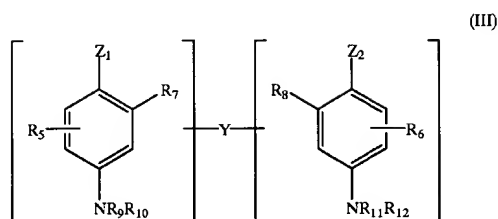
- R<sub>1</sub> represents a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>2</sub>-C<sub>4</sub> polyhydroxyalkyl radical, a (C<sub>1</sub>-C<sub>4</sub>)alkoxy(C<sub>1</sub>-C<sub>4</sub>)alkyl radical, a C<sub>1</sub>-C<sub>4</sub> alkyl radical substituted with a nitrogenous group, a phenyl radical or a 4'-aminophenyl radical;
- R<sub>2</sub> represents a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>2</sub>-C<sub>4</sub> polyhydroxyalkyl radical, a (C<sub>1</sub>-C<sub>4</sub>)alkoxy(C<sub>1</sub>-C<sub>4</sub>)alkyl radical or a C<sub>1</sub>-C<sub>4</sub> alkyl radical substituted with a nitrogenous group;
- R<sub>3</sub> represents a hydrogen atom, a halogen atom such as a chlorine, bromine, iodine or fluorine atom, a C<sub>1</sub>-C<sub>4</sub> alkyl radical, a C<sub>1</sub>-C<sub>4</sub> monohydroxyalkyl radical, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkoxy radical, an acetyl-amino(C<sub>1</sub>-C<sub>4</sub>)alkoxy radical, a C<sub>1</sub>-C<sub>4</sub> mesylaminoalkoxy radical or a carbamoylamino(C<sub>1</sub>-C<sub>4</sub>)alkoxy radical;
- R<sub>4</sub> represents a hydrogen or halogen atom or a C<sub>1</sub>-C<sub>4</sub>

alkyl radical.

Among the nitrogenous groups of formula (II) above, mention may be made in particular of amino, mono(C<sub>1</sub>-C<sub>4</sub>)alkylamino, di(C<sub>1</sub>-C<sub>4</sub>)alkylamino, tri(C<sub>1</sub>-C<sub>4</sub>)alkylamino, monohydroxy(C<sub>1</sub>-C<sub>4</sub>)alkylamino, imidazolium and ammonium radicals.

Among the para-phenylenediamines of formula (II) above, mention may be made more particularly of para-phenylenediamine, para-toluylenediamine, 2-chloro-  
10 para-phenylenediamine, 2,3-dimethyl-para-phenylene-  
diamine, 2,6-dimethyl-para-phenylenediamine, 2,5-dimethyl-para-  
phenylenediamine, N,N-dimethyl-para-phenylenediamine, N,N-diethyl-para-phenylenediamine, N,N-dipropyl-para-  
15 phenylenediamine, 4-amino-N,N-diethyl-3-methylaniline, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 4-amino-N,N-bis(β-hydroxyethyl)-2-methylaniline, 4-amino-2-chloro-N,N-bis(β-hydroxyethyl)aniline, 2-β-hydroxy-ethyl-para-phenylenediamine, 2-fluoro-para-phenylene-  
20 diamine, 2-isopropyl-para-phenylenediamine, N-(β-hydroxypropyl)-para-phenylenediamine, 2-hydroxymethyl-para-phenylenediamine, N,N-dimethyl-3-methyl-para-phenylenediamine, N,N-(ethyl-β-hydroxyethyl)-para-phenylenediamine, N-(β,γ-dihydroxypropyl)-para-  
25 phenylenediamine, N-(4'-aminophenyl)-para-phenylene-diamine, N-phenyl-para-phenylenediamine, 2-β-hydroxy-ethyloxy-para-phenylenediamine, 2-β-acetylamino-ethyloxy-para-phenylenediamine and N-(β-methoxyethyl)-para-phenylenediamine, and the addition salts thereof  
30 with an acid.

Among the para-phenylenediamines of formula (II) above, para-phenylenediamine, para-toluylenediamine, 2-isopropyl-para-phenylenediamine, 2-β-hydroxyethyl-para-phenylenediamine, 2-β-hydroxy-  
35 ethyloxy-para-phenylenediamine, 2,6-dimethyl-para-phenylenediamine, 2,6-diethyl-para-phenylenediamine, 2,3-dimethyl-para-phenylenediamine, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 2-chloro-para-phenylene-diamine and 2-β-acetylaminoethyloxy-para-phenylene-



[0049] in which:

[0050]  $Z_1$  and  $Z_2$ , which may be identical or different, represent a hydroxyl or  $\text{—NH}_2$  radical which may be substituted with a  $\text{C}_1\text{—C}_4$  alkyl radical or with a linker arm Y;

[0051] the linker arm Y represents a linear or branched alkylene chain containing from 1 to 14 carbon atoms, which may be interrupted by or terminated with one or more nitrogenous groups and/or one or more hetero atoms such as oxygen, sulphur or nitrogen atoms, and optionally substituted with one or more hydroxyl or  $\text{C}_1\text{—C}_6$  alkoxy radicals;

[0052]  $R_5$  and  $R_6$  represent a hydrogen or halogen atom, a  $\text{C}_1\text{—C}_4$  alkyl radical, a  $\text{C}_1\text{—C}_4$  monohydroxyalkyl radical, a  $\text{C}_2\text{—C}_4$  polyhydroxyalkyl radical, a  $\text{C}_1\text{—C}_4$  aminoalkyl radical or a linker arm Y;

[0053]  $R_7$ ,  $R_8$ ,  $R_9$ ,  $R_{10}$ ,  $R_{11}$  and  $R_{12}$ , which may be identical or different, represent a hydrogen atom, a linker arm Y or a  $\text{C}_1\text{—C}_4$  alkyl radical;

[0054] it being understood that the compounds of formula (III) contain only one linker arm Y per molecule.

[0055] Among the nitrogenous groups of formula (III) above, mention may be made in particular of amino, mono ( $\text{C}_1\text{—C}_4$ ) alkylamino, di ( $\text{C}_1\text{—C}_4$ ) alkylamino, tri ( $\text{C}_1\text{—C}_4$ ) alkylamino, monohydroxy ( $\text{C}_1\text{—C}_4$ ) alkylamino, imidazolinium and ammonium radicals.

[0056] Among the double bases of formula (III) above, mention may be made more particularly of  $\text{N,N'}$ -bis( $\beta$ -hydroxyethyl)- $\text{N,N'}$ -bis(4'-aminophenyl)-1,3-diaminopropanol,  $\text{N,N'}$ -bis( $\beta$ -hydroxyethyl)- $\text{N,N'}$ -bis(4'-aminophenyl)ethylenediamine,  $\text{N,N'}$ -bis(4'-aminophenyl)-tetramethylenediamine,  $\text{N,N'}$ -bis( $\beta$ -hydroxyethyl)- $\text{N,N'}$ -bis(4'-aminophenyl)tetramethylenediamine,  $\text{N,N'}$ -bis(4-methylaminophenyl)tetramethylenediamine,  $\text{N,N'}$ -bis(ethyl)- $\text{N,N'}$ -bis(4'-amino-3'-methylphenyl)ethylenediamine and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane, and the addition salts thereof with an acid.

[0057] Among these double bases of formula (III),  $\text{N,N'}$ -bis( $\beta$ -hydroxyethyl)- $\text{N,N'}$ -bis(4'-aminophenyl)-1,3-diaminopropanol and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane, or one of the addition salts thereof with an acid, are particularly preferred.

[0058] Among the para-aminophenols which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made in particular of the compounds corresponding to formula (IV) below, and the addition salts thereof with an acid:

[0059] in which:

[0060]  $R_{13}$  represents a hydrogen or halogen atom or a  $\text{C}_1\text{—C}_4$  alkyl,  $\text{C}_1\text{—C}_4$  monohydroxyalkyl, ( $\text{C}_1\text{—C}_4$ )alkoxy( $\text{C}_1\text{—C}_4$ )alkyl,  $\text{C}_1\text{—C}_4$  aminoalkyl or hydroxy( $\text{C}_1\text{—C}_4$ )alkylamino-( $\text{C}_1\text{—C}_4$ )alkyl radical,

[0061]  $R_{14}$  represents a hydrogen or halogen atom or a  $\text{C}_1\text{—C}_4$ -alkyl,  $\text{C}_1\text{—C}_4$  monohydroxyalkyl,  $\text{C}_2\text{—C}_4$  polyhydroxyalkyl,  $\text{C}_1\text{—C}_4$  aminoalkyl,  $\text{C}_1\text{—C}_4$  cyanoalkyl or ( $\text{C}_1\text{—C}_4$ ) alkoxy-( $\text{C}_1\text{—C}_4$ ) alkyl radical,

[0062] it being understood that at least one of the radicals  $R_{13}$  or  $R_{14}$  represents a hydrogen atom.

[0063] Among the para-aminophenols of formula (IV) above, mention may be made more particularly of para-aminophenol, 4-amino-3-methylphenol, 4-amino-3-fluorophenol, 4-amino-3-hydroxymethylphenol, 4-amino-2-methylphenol, 4-amino-2-hydroxymethylphenol, 4-amino-2-methoxymethylphenol, 4-amino-2-aminomethylphenol, 4-amino-2-( $\beta$ -hydroxyethylaminomethyl)phenol and 4-amino-2-fluorophenol, and the addition salts thereof with an acid.

[0064] Among the ortho-aminophenols which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made more particularly of 2-aminophenol, 2-amino-5-methylphenol, 2-amino-6-methylphenol and 5-acetamido-2-aminophenol, and the addition salts thereof with an acid.

[0065] Among the heterocyclic bases which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made more particularly of pyridine derivatives, pyrimidine derivatives, pyrazole derivatives and pyrazolo-pyrimidine derivatives, and the addition salts thereof with an acid.

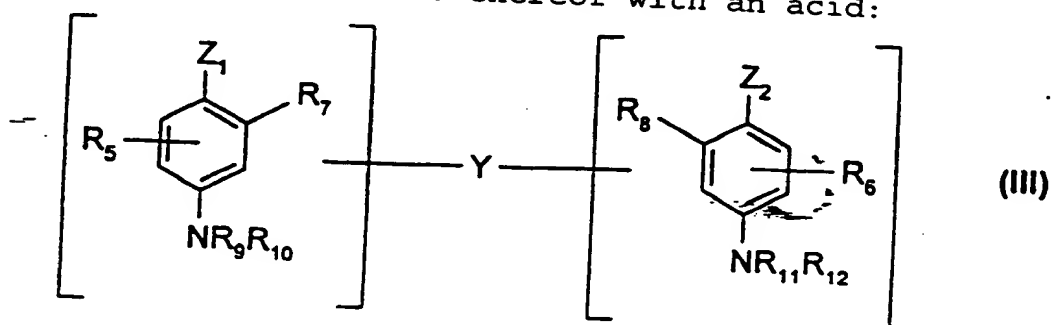
[0066] Among the pyridine derivatives, mention may be made more particularly of the compounds described, for example, in patents GB 1,026,978 and GB 1,153,196, such as 2,5-diaminopyridine, 2-(4-methoxyphenyl)amino-3-aminopyridine, 2,3-diamino-6-methoxypyridine, 2-( $\beta$ -methoxyethyl)amino-3-amino-6-methoxypyridine and 3,4-diaminopyridine, and the addition salts thereof with an acid.

[0067] Among the pyrimidine derivatives, mention may be made more particularly of the compounds described, for example, in German patent DE 2,359,399 or Japanese patent JP 88-169,571 or patent application WO 96/15765, such as 2,4,5,6-tetraaminopyrimidine, 4-hydroxy-2,5,6-triaminopyrimidine, 2-hydroxy-4,5,6-triaminopyrimidine, 2,4-dihydroxy-5,6-diaminopyrimidine and 2,5,6-triaminopyrimidine, and the addition salts thereof with an acid.

diamine and the addition salts thereof with an acid are most particularly preferred.

According to the invention, the term double bases is understood to refer to the compounds containing at least two aromatic rings bearing amino and/or hydroxyl groups.

Among the double bases which can be used as oxidation bases in the dye compositions in accordance with the invention, mention may be made in particular of the compounds corresponding to formula (III) below, and the addition salts thereof with an acid:

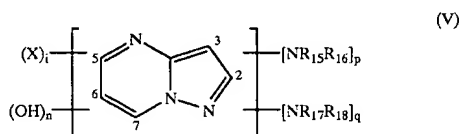


in which:

- $\text{Z}_1$  and  $\text{Z}_2$ , which may be identical or different, represent a hydroxyl or  $-\text{NH}_2$  radical which may be substituted with a  $\text{C}_1$ - $\text{C}_4$  alkyl radical or with a linker arm Y;
  - the linker arm Y represents a linear or branched alkylene chain containing from 1 to 14 carbon atoms, which may be interrupted by or terminated with one or more nitrogenous groups and/or one or more hetero atoms such as oxygen, sulphur or nitrogen atoms, and optionally substituted with one or more hydroxyl or  $\text{C}_1$ - $\text{C}_6$  alkoxy radicals;
  - $\text{R}_5$  and  $\text{R}_6$  represent a hydrogen or halogen atom, a  $\text{C}_1$ - $\text{C}_4$  alkyl radical, a  $\text{C}_1$ - $\text{C}_4$  monohydroxyalkyl radical, a  $\text{C}_2$ - $\text{C}_4$  polyhydroxyalkyl radical, a  $\text{C}_1$ - $\text{C}_4$  aminoalkyl radical or a linker arm Y;
  - $\text{R}_7$ ,  $\text{R}_8$ ,  $\text{R}_9$ ,  $\text{R}_{10}$ ,  $\text{R}_{11}$  and  $\text{R}_{12}$ , which may be identical or different, represent a hydrogen atom, a linker arm Y or a  $\text{C}_1$ - $\text{C}_4$  alkyl radical;
- it being understood that the compounds of formula (III) contain only one linker arm Y per molecule.

[0068] Among the pyrazole derivatives, mention may be made more particularly of the compounds described in patents DE 3,843,892, DE 4,133,957 and patent applications WO 94/08969, WO 94/08970, FR-A-2,733,749 and DE 195 43 988, such as 4,5-diamino-1-methyl-pyrazole, 3,4-diaminopyrazole, 4,5-diamino-1-(4'-chlorobenzyl)pyrazole, 4,5-diamino-1,3-dimethyl-pyrazole, 4,5-diamino-3-methyl-1-phenylpyrazole, 4,5-diamino-1-methyl-3-phenylpyrazole, 4-amino-1,3-dimethyl-5-hydrazinopyrazole, 1-benzyl-4,5-diamino-3-methylpyrazole, 4,5-diamino-3-tert-butyl-1-methylpyrazole, 4,5-diamino-1-tert-butyl-3-methylpyrazole, 4,5-diamino-1-( $\beta$ -hydroxyethyl)-3-methylpyrazole, 4,5-diamino-1-ethyl-3-methylpyrazole, 4,5-diamino-1-ethyl-3-(4'-methoxyphenyl)pyrazole, 4,5-diamino-1-ethyl-3-hydroxymethylpyrazole, 4,5-diamino-3-hydroxymethyl-1-methylpyrazole, 4,5-diamino-3-hydroxymethyl-1-isopropylpyrazole, 4,5-diamino-3-methyl-1-isopropylpyrazole, 4-amino-5-(2'-aminoethyl)amino-1,3-dimethyl-pyrazole, 3,4,5-triaminopyrazole, 1-methyl-3,4,5-triaminopyrazole, 3,5-diamino-1-methyl-4-methylamino-pyrazole and 3,5-diamino-4-( $\beta$ -hydroxyethyl)amino-1-methylpyrazole, and the addition salts thereof with an acid.

[0069] Among the pyrazolopyrimidine derivatives, mention may be made more particularly of the pyrazolo[1,5-a]pyrimidines of formula (V) below, and the addition salts thereof with an acid or with a base and the tautomeric forms thereof, when a tautomeric equilibrium exists:



[0070] in which:

[0071]  $R_{15}$ ,  $R_{16}$ ,  $R_{17}$  and  $R_{18}$ , which may be identical or different, denote a hydrogen atom, a  $C_1$ - $C_4$  alkyl radical, an aryl radical, a  $C_1$ - $C_4$  hydroxyalkyl radical, a  $C_1$ - $C_4$  polyhydroxyalkyl radical, a  $(C_1$ - $C_4$ )alkoxy( $C_1$ - $C_4$ )alkyl radical, a  $C_1$ - $C_4$  aminoalkyl radical (it being possible for the amine to be protected with an acetyl, ureido or sulphonyl radical), a  $(C_1$ - $C_4$ )alkylamino( $C_1$ - $C_4$ )alkyl radical, a di[( $C_1$ - $C_4$ )alkyl]amino( $C_1$ - $C_4$ )alkyl radical (it being possible for the dialkyl radicals to form a 5- or 6-membered carbon-based ring or a heterocycle), a hydroxy( $C_1$ - $C_4$ )alkyl- or di[hydroxy-( $C_1$ - $C_4$ )alkyl]amino( $C_1$ - $C_4$ )alkyl radical;

[0072] the radicals X, which may be identical or different, denote a hydrogen atom, a  $C_1$ - $C_4$  alkyl radical, an aryl radical, a  $C_1$ - $C_4$  hydroxyalkyl radical, a  $C_2$ - $C_4$  polyhydroxyalkyl radical, a  $C_1$ - $C_4$  aminoalkyl radical, a  $(C_1$ - $C_4$ )alkylamino( $C_1$ - $C_4$ )alkyl radical, a di[( $C_1$ - $C_4$ )alkyl]amino( $C_1$ - $C_4$ )alkyl radical (it being possible for the dialkyls to form a 5- or 6-membered carbon-based ring or a heterocycle), a hydroxy( $C_1$ - $C_4$ )alkyl- or di[hydroxy( $C_1$ - $C_4$ )alkyl]amino( $C_1$ - $C_4$ )alkyl radical, an amino radical, a  $(C_1$ - $C_4$ )alkyl- or di[( $C_1$ - $C_4$ )alkyl]amino radical; a halogen atom, a carboxylic acid group or a sulphonic acid group;

[0073] i is equal to 0, 1, 2 or 3;

[0074] p is equal to 0 or 1;

[0075] q is equal to 0 or 1;

[0076] n is equal to 0 or 1;

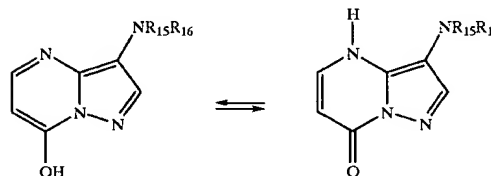
[0077] with the proviso that:

[0078] the sum  $p+q$  is other than 0;

[0079] when  $p+q$  is equal to 2, then n is equal to 0 and the groups  $NR_{15}R_{16}$  and  $NR_{17}R_{18}$  occupy the (2,3); (5,6) (6,7); (3,5) or (3,7) positions;

[0080] when  $p+q$  is equal to 1, then n is equal to 1 and the group  $NR_{15}R_{16}$  (or  $NR_{17}R_{18}$ ) and the OH group occupy the (2,3); (5,6); (6,7); (3,5) or (3,7) positions.

[0081] When the pyrazolo[1,5-a]pyrimidines of formula (V) above are such that they contain a hydroxyl group on one of the positions 2, 5 or 7, a tautomeric equilibrium exists represented, for example, by the following scheme:



[0082] Among the pyrazolo[1,5-a]pyrimidines of formula (V) above, mention may be made in particular of:

[0083] pyrazolo[1,5-a]pyrimidine-3,7-diamine;

[0084] 2,5-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;

[0085] pyrazolo[1,5-a]pyrimidine-3,5-diamine;

[0086] 2,7-dimethylpyrazolo[1,5-a]pyrimidine-3,5-diamine;

[0087] 3-aminopyrazolo[1,5-a]pyrimidin-7-ol;

[0088] 3-aminopyrazolo[1,5-a]pyrimidin-5-ol;

[0089] 2-(3-aminopyrazolo[1,5-a]pyrimidin-7-ylamino)ethanol;

[0090] 2-(7-aminopyrazolo[1,5-a]pyrimidin-3-ylamino)ethanol;

[0091] 2-[(3-aminopyrazolo[1,5-a]pyrimidin-7-yl)-(2-hydroxyethyl)amino]ethanol;

[0092] 2-[(7-aminopyrazolo[1,5-a]pyrimidin-3-yl)-(2-hydroxy-ethyl)amino]ethanol;

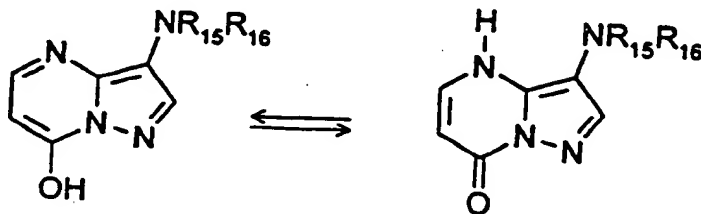
[0093] 5,6-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;

[0094] 2,6-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;

[0095] 2,5,N7,N7-tetramethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;

[0096] and the addition salts thereof and the tautomeric forms thereof, when a tautomeric equilibrium exists.

on one of the positions 2, 5 or 7 α to a nitrogen atom, a tautomeric equilibrium exists represented, for example, by the following scheme:



5 Among the pyrazolo[1,5-a]pyrimidines of formula (V) above, mention may be made in particular of:

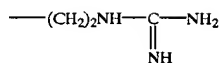
- pyrazolo[1,5-a]pyrimidine-3,7-diamine;
- 2,5-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;
- pyrazolo[1,5-a]pyrimidine-3,5-diamine;
- 10 - 2,7-dimethylpyrazolo[1,5-a]pyrimidine-3,5-diamine;
- 3-aminopyrazolo[1,5-a]pyrimidin-7-ol;
- 3-aminopyrazolo[1,5-a]pyrimidin-5-ol;
- 2-(3-aminopyrazolo[1,5-a]pyrimidin-7-ylamino)ethanol;
- 2-(7-aminopyrazolo[1,5-a]pyrimidin-3-ylamino)ethanol;
- 15 - 2-[(3-aminopyrazolo[1,5-a]pyrimidin-7-yl)-(2-hydroxyethyl)amino]ethanol;
- 2-[(7-aminopyrazolo[1,5-a]pyrimidin-3-yl)-(2-hydroxyethyl)amino]ethanol;
- 5,6-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;
- 20 - 2,6-dimethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;
- 2,5,N7,N7-tetramethylpyrazolo[1,5-a]pyrimidine-3,7-diamine;

and the addition salts thereof and the tautomeric forms thereof, when a tautomeric equilibrium exists.

25 The pyrazolo[1,5-a]pyrimidines of formula (V) above can be prepared by cyclization starting with an aminopyrazole, according to the syntheses described in the following references:

- EP 628559 Beiersdorf-Lilly.
- 30 - R. Vishdu, H. Navedul, Indian J. Chem., 34b (6), 514, 1995.
- N.S. Ibrahim, K.U. Sadek, F.A. Abdel-Al, Arch. Pharm., 320, 240, 1987.
- R.H. Springer, M.B. Scholten, D.E. O'Brien,
- 35 T. Novinson, J.P. Miller, R.K. Robins, J. Med. Chem.,





9. Composition according to any one of claims 1 to 8, characterized in that the concentration of basic amino acid ranges from 0.01% to 20% by weight relative to the total weight of the composition, and preferably between 0.05 and 5%.

10. Ready-to-use composition according to any one of claims 1 to 9, for the oxidation dyeing of keratin fibres, and in particular human keratin fibres such as the hair, of the type also comprising, in a medium which is suitable for keratin fibres, at least one oxidation base and, optionally, one or more couplers.

11. Composition according to claim 10, characterized in that the oxidation bases are chosen from para-phenylenediamines, double bases, ortho- or para-aminophenols and heterocyclic bases, as well as the addition salts of these compounds with an acid.

12. Composition according to claim 10 or 11, characterized in that the oxidation bases are present in concentrations ranging from 0.0005 to 12% by weight relative to the total weight of the composition.

13. Composition according to claim 10, characterized in that the couplers are chosen from meta-phenylenediamines, meta-aminophenols, meta-diphenols and heterocyclic couplers, and the addition salts of these compounds with an acid.

14. Composition according to claim 10 or 13, characterized in that the couplers are present in concentrations ranging from 0.0001 to 10% by weight relative to the total weight of the composition.

15. Composition according to claim 11 or 13, characterized in that the addition salts with an acid for the oxidation bases and the couplers are chosen from the hydrochlorides, hydrobromides, sulphates, tartrates, lactates and acetates.

16. Composition according to any one of claims 10 to 15, characterized in that it also contains direct dyes.

17. Composition according to any one of claims 1 to 16, characterized in that the medium which is suitable for the keratin fibres (or support) consists of water or of a mixture of water and at least one organic solvent.

18. Composition according to claim 17, characterized in that the organic solvents can be present in proportions preferably ranging from 1 to 40% by weight relative to the total weight of the composition, and even more preferably ranging from 5 to 30% by weight.

19. Composition according to any one of claims 1 to 18, characterized in that the pH ranges from 5 to 11 and preferably from 6.5 to 10.

20. Composition according to any one of claims 1 to 19, characterized in that it also contains at least one cosmetic

adjuvant used conventionally in compositions for dyeing, permanently reshaping or bleaching the hair, chosen from the group consisting of anionic, cationic, nonionic, amphoteric or zwitterionic surfactants or mixtures thereof, anionic, cationic, nonionic, amphoteric or zwitterionic polymers or mixtures thereof, inorganic or organic thickeners, antioxidants, enzymes other than the 2-electron oxidoreductases, penetration agents, sequestering agents, fragrances, buffers, dispersing agents, conditioners, film-forming agents, preserving agents and opacifiers.

21. Process for dyeing keratin fibres, and in particular human keratin fibres such as the hair, characterized in that at least one ready-to-use dye composition as defined in any one of claims 10 to 20 is applied to the said fibres, for a period which is sufficient to develop the desired coloration.

22. Process according to claim 21, characterized in that it includes a first step which consists in separately storing, on the one hand, a composition (A) comprising, in a medium which is suitable for dyeing, at least one oxidation base and optionally at least one coupler as defined in any one of claims 10 to 16, and, on the other hand, a composition (B) containing, in a medium which is suitable for keratin fibres, at least one enzyme of 2-electron oxidoreductase type in the presence of at least one donor for the said enzyme as defined in any one of the preceding claims, and then in mixing them together at the time of use, before applying this mixture to the keratin fibres; composition (A) or composition (B) containing the basic amino acid as defined in the preceding claims.

23. Multi-compartment dyeing device or "kit", characterized in that it contains a first compartment containing composition (A) as defined in claim 22 and a second compartment containing composition (B) as defined in claim 22.

24. Process for treating keratin fibres, in particular the hair, in order to obtain a permanent reshaping of this hair, in particular in the form of permanent-waved hair, this process comprising the following steps: (i) a reducing composition is applied to the keratin fibres to be treated, the keratin substance being placed under mechanical tension before, during or after the said application, (ii) the keratin substance is optionally rinsed, (iii) an oxidizing composition as defined in any one of claims 1 to 9 and 17 to 20 is applied to the optionally rinsed keratin substance, (iv) the keratin substance is optionally rinsed again.

25. Process for treating keratin fibres, in particular the hair, in order to bleach them, this process comprising the application of an oxidizing composition as defined in any one of claims 1 to 5 and 17 to 20 optionally containing an auxiliary oxidizing agent and a second step of rinsing the keratin fibres.

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substance, (iv) the keratin substance is optionally rinsed again.

25. Process for treating keratin fibres, in particular the hair, in order to bleach them, this  
5 process comprising the application of an oxidizing composition as defined in any one of Claims 1 to 9 and 17 to 20 optionally containing an auxiliary oxidizing agent and a second step of rinsing the keratin fibres.